DELAYED CALL ESTABLISHMENT

BACKGROUND

In packet-based multimedia networks, such as those in accordance with the International Telecommunications Union (ITU) Recommendation H.323 or the Internet Engineering Task Force (IETF) RFC 3261 (SIP), the capability to initiate a call without completing it, delay alerting the called user or entity, or prematurely releasing the call before alerting the called user or entity, may prove useful. This deliberate delay in alerting the user, or prematurely releasing the call, is referred to here as delayed call establishment.

Generally, two types of calls are used in H.323 networks. The first is real, or actual, calls, where one endpoint calls the other and the user's phone rings. The other type of call may be referred to as non-call associated services, such as a message waiting indicator. Within SIP networks, only real or actual calls exist.

In the case of real calls, it is impossible for a system to initiate a call for whatever purpose for which it does not want the user to be aware, as it would cause the user's phone to ring. On the other hand, if the call were initiated for some purpose and the goal is to be able to complete the call only after certain events occur or certain requirements are satisfied, albeit with a delay, non-real calls are not useful, as they cannot be converted into real calls.

The reasons for initiating a call, but not completing it or alerting the called party, may be varied. For example, a calling endpoint may want to perform a feature discovery process on the other endpoint. If the features between endpoints match, the call could then be progressed to the established state. However, in current implementations, the user's phone would ring and then there would be a delay while feature discovery is performed. The possibility exists that features will not match and the call cannot be completed.

Similarly, the ability to delay call establishment may be useful for providing services such as call completion on busy and call completion on no answer, where for instance, an

intermediate device between the calling endpoint and the receiving endpoint continues to call the receiving endpoint until the line is not busy. Once the line is no longer busy, the intermediate device calls the calling endpoint and completes the call. Currently, this is not possible in H.323 or SIP networks. Other uses may include quality of service testing and coordinating with policy enforcement functions to manipulate media ports during call establishment.

SUMMARY

One embodiment of the invention is a network device. The network device includes a port to allow the device to communicate with a called endpoint and a processor. The processor sends a call request message associated with a call to the called endpoint and receives a notification that a delay point has been reached. Once the delay point has been reached the processor determines if the call is to be established, and if the call is to be established, notify the called endpoint.

Another embodiment of the invention is a method to delay call establishment. The method transmits a call request and identifies a delay point. If delayed call establishment is available, a notification that a delay point has been reached may be received. If the call is to be established the called endpoint is notified and the call is completed. The method may not require an explicit indication that the delay point has been reached or an explicit notification to progress the call. For example, the calling device may instruct the called endpoint to proceed automatically once the delay point is reached.

Another embodiment of the invention is a network device. The network device includes a port to allow the device to communicate with a calling endpoint and a processor. The processor receives a call request message associated with a call from the calling endpoint and responds with a notification of delayed call establishment availability. The processor processes the call to a delay point, if one has been specified by the calling endpoint, at which point the processor further transmits a notification that the delay point has been reached. The

processor determines if the call is to be established and, if the call is to be established, it notifies a user.

Another embodiment of the invention is a method to delay call establishment at the called endpoint. A call request with delayed call establishment requested is received. The calling endpoint is notified of the delayed call establishment availability. The call setup proceeds until the delay point is reached. When the delay point is reached, the called endpoint may notify the calling endpoint, unless no explicit indication is requested. The call is then processed according to instructions from the calling endpoint.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention may be best understood by reading the disclosure with reference to the drawings, wherein:

Figure 1 shows a voice over data networks telephony system.

Figure 2 shows a flowchart of an embodiment of a method to initiate a call with delayed call establishment.

Figure 3 shows a flowchart of an embodiment of a method to receive a call with delayed call establishment.

Figure 4 shows a call flow diagram of one example of delayed call establishment in a call back busy signal situation.

Figure 5 shows a call flow diagram of an example of delayed call establishment for maintenance purposes.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Figure 1 shows a telephony system. In the telephony system, the phone calls between users are relayed across a data network, such as an Internet Protocol (IP) network. These types of calls are usually referred to as voice over IP systems (VoIP), and may be referred to

as such here. No limitation to IP networks is implied or intended, as the implementations of the embodiments of the invention may be used for data networks other than IP.

In the system, a user at calling endpoint 10 places a call to a user at the called endpoint 18. In some instances, the calling endpoint may be a traditional, publicly switched telephone network (PSTN), telephone with a handset and base. In others, the calling endpoint may be a computer equipped with a headset, modem and a microphone. Many other alternatives may also exist, such as VoIP or network phones, etc.

The calling endpoint generally connects to an intermediary of some kind. In H.323, an International Telecommunications Union (ITU) recommendation titled "Packet Based Multimedia Communications Systems," this entity may be a gatekeeper. In Session Initiation Protocol (SIP) systems, the entity may be a SIP proxy server. These intermediaries 12 and 16 connect the calling endpoint 10 with the called endpoint 18.

The intermediary, which may be device 12 or 16, may be a network device having a processor 20 and port or ports 22. The ports 22 allow the device to make connection with the network and communicate with the endpoint through the port. The endpoints may also be configured in a similar manner as the intermediaries, with ports and processors. The embodiments of the invention may be implemented as an article of machine-readable media used to provide the machines such as the intermediaries or the endpoints with instructions. When the instructions are executed, the machine performs the methods of the invention. These methods will be discussed in more detail below.

As was mentioned previously, situations may arise where it is beneficial for a calling endpoint to initiate a call with a called endpoint, but delay the establishment of the call. One benefit of delayed call establishment would be to determine the capabilities of the endpoint. In H.323 for example, most entities may initiate either a 'real' call or call-independent supplementary service signaling, which may be referred to as a non-call. The non-call case may not be suitable for feature discovery, as some features may not be exchanged during the

supplementary service signaling. If it becomes desirable to turn the call into a real call, if the sought after features are available, a non-call would be unsuitable, as it cannot be turned into a real call.

Another benefit may allow network entities to provide supplementary services, such as call completion on busy and call completion on no answer. In these situations, it will be an intermediary, rather than an endpoint, performing the delayed call establishment exchanges discussed below. Call completion on busy and call completion on no answer allow the user at the calling station to turn over the completion of the call to another device, rather than having to continually re-dial to reach the called user.

There is a recommendation for these completion services in H.323, recommendation H.450.9 "Call Completion Supplementary Services for H.323." This recommendation requires more development on the endpoint than utilizing a delayed call establishment process. In order to provide accurate billing records, this recommendation uses a complicated 'call linkage' field and the subsequent correlation of the call records with previous calls. Even a temporary loss of power to the endpoint may render H.450.9 useless. Using delayed call establishment, an intermediary could periodically initiate a call to the called endpoint and instruct it to delay call establishment, thereby not alerting the called entity. Once it is determined that the called entity is available, the intermediary could then initiate a call to the calling endpoint, allow the initial call to proceed, and bridge the call legs.

Another possible benefit of delayed call establishment is for continuity or quality of service (QoS) testing or other diagnostic testing. In H.323, for example, there is a testing mode wherein media may be looped back to the calling device. However, no current signaling mechanisms allow an endpoint to distinguish between a normal call and a testing call. The called user's phone would ring. The use of delayed call establishment would allow operators and administrators to tests without alerting the user.

It must be noted that a 'user' as the term is used here does not necessarily mean a human being. The 'user' may be an automated system, such as an interactive voice response system. The user is alerted, even if that user is an automated or other non-living system.

Another possible use of delayed call establishment allows a policy enforcement function to ensure that media ports are properly opened prior to call completion. If policy enforcement is done in parallel with call establishment and not coordinated, it is possible that the call could be established and media could flow before ports are properly opened. This may result in media clipping, degrading the quality of service. All of these issues may be resolved with the use of delayed call establishment.

In order to understand the embodiments of the invention, some definitions may be helpful. Delayed call establishment as used here means a process in which a call is allowed to be initiated, but not to progress to the point where the user is alerted or the call is connected. As part of this process, the call may reach a delay point (DP), which is the point in the call establishment process that must be reached before the call may proceed to the Alerting or Connected state in H.323 terminology or '180 Ringing' or '200 OK' in SIP terminology. The delay point is some point in the call establishment process to which the called endpoint shall progress the call before pausing the call establishment process. Specifically, delaying the call establishment essentially means that signaling messages may be exchanged up to and even after the delay point is reached, but the called user is never alerted. DP Reached, or DPR, is a message transmitted by the called endpoint to the calling endpoint to indicate that the DP has been reached. DCE Release, Delayed Call Establishment Release, is a message transmitted by the calling entity to the called endpoint releasing the endpoint from the DCE procedures and allowing the call to proceed as normal. The DCE Release may be implicit in the case wherein the calling entity did not request explicit notification of DPR.

A method of delayed call establishment is shown in Figure 2. At 40 a call request associated with a call is transmitted from a calling endpoint to a called endpoint. The call request, which may be an incoming call, may also included the delay point to which the calling endpoint wants the called endpoint to progress to before delaying the call establishment. When the called endpoint receives the incoming call request, it would typically advertise this capability in the list of supported features when responding to the request. If the called endpoint does not support delayed call establishment capabilities, then the call may proceed as a normal call or may terminate, depending on whether the capability was advertised as a mandatory or desired feature.

The delay point may be included using a Delay Point Indicator, which indicates a point of interest to the calling entity in the establishment process. The DPI may have several possible meanings. A list of examples is shown in the following table.

DPI Value	Meaning
0	NULL / Explicit Notification
1	Terminal Capabilities are received by the called endpoint
2	Master/Slave determination complete
3	Media channels are opened from the called endpoint
4	Media channels are opened to the called endpoint
5	Media channels are established bi-directionally

The DPI values in the above example are independent and suggest no ordering of events. For example, it is possible that media may be established bi-directionally prior to the determination of Master/Slave in H.323 networks. NULL/Explicit Notification simply indicates that no explicit conditions exist that must be satisfied before reaching the Delay Point. The DP is reached immediately upon reception of the initial setup message. For example, sending NULL in an outgoing H.323 Setup message merely means that the called endpoint has nothing more to do than to determine that it is ready to proceed with call establishment, indicating that the called endpoint is not busy. The DP is the point at which all of the conditions are satisfied. If the DPI is 2 and 5, the DP is when both the Master/Slave negotiation is completed and the bi-direction media flows are opened.

Upon reception of a call setup message that includes a DCE request and a DPI, the called endpoint should respond indicating support or no support. This allows the calling endpoint to know whether or not DCE is available at 42. If DCE is available, the called endpoint will progress the call to the Delay Point and then, if explicit notification is requested, notify the calling entity that the point has been reached. When explicit notification is requested, the calling entity then receives the notification of delay point at 44.

The called entity may transmit the Delay Point Reached (DPR) message through an appropriate message, such as a Facility message in H.323 or 183 (Session Progress) in SIP, with the DCE capability advertised and the DPR parameter. In one embodiment the DPR parameter may have a parameter identifier by not an associated type. In another embodiment, no explicit capability advertisement is required.

At 46, the calling entity optionally determines whether or not to proceed with the call establishment. In one embodiment this may be implicitly assumed to be true by the called entity. Determining that the call should be established at 46 will result in the user being notified at the called endpoint or the call will simply be connected. If the goal of the call were for a non-user reason, such as QoS testing, the calling entity would not want the call establishment to continue. If the call is to be established and explicit indication is required, the calling endpoint notifies the called endpoint at 48 by sending a DCE Release message. This notifies the called endpoint that it is time to alert the user, ultimately resulting in the called endpoint completing the call at 50.

If the user is not to be alerted, such as a call for testing purposes, the called endpoint will not receive a DCE Release message until further call processing is performed at 58. The called endpoint will be released from DCE upon termination of the call at 52. It is also possible that the call will perform other call processing and then progress back to process 48 to complete the call. For example, the intermediate entity may want to establish media, test for quality and, seeing acceptable quality, progress the call to an established state.

An embodiment of a method to provide delayed call establishment as seen from the called endpoint is shown in Figure 3. At 60 the called endpoint receives the call request will the delay point indicated by the DPI. If the called endpoint does not have DCE capability, the process would end. For the purpose of this discussion, the endpoint will be assumed to have DCE capability. The called endpoint will usually send the capability advertisement in response to the request at 62. The called endpoint then proceeds with call setup at 64, continuing to monitor for the delay point being reached at 66. It must be noted that if the DPI received in the call request message is NULL, proceeding with the call setup may include only acknowledging that that Setup (H.323) or INVITE (SIP) message was received and that the delay point has been reached.

Once the delay point has been reached, at 66, the called endpoint, if not instructed otherwise, transmits a DPR message to the calling endpoint at 68. The call is then processed according to the instructions, or lack of instructions, from the calling endpoint at 70. The instruction from the calling endpoint may be a DCE Release message, which would result in the call processing at 70 being the task of alerting the user. Note that a DCE Release may be implicit, if so indicated in the initial call signaling messages.

Examples of situations in which delayed call establishment may be used are shown in Figures 4 and 5. Figure 4 shows a call flow for continuity, QoS, or other testing. In Figure 4, the testing device transmits a setup message with the delay point being reached when bi-directional media is established. The term endpoint was used above, and it must be noted that the calling entity may not be an actual endpoint, such as a user's phone. It may be a network intermediary that initiates testing, but that will act as the calling endpoint in this type of situation.

The tested endpoint transmits a call proceeding message. Terminal capabilities are exchanged and Master/Slave negotiation takes place. The logical channel signaling occurs and then bi-direction media is established. At this point, the tested endpoint transmits a

facility or other appropriate message with the DPR indicator contained within it. In this example, the call purpose was to perform maintenance testing, so maintenance loop requests and acknowledgements are exchanged, and the testing commences. Upon the end of the testing, the maintenance mode is exited and the call is released. This entire process did not involve any user notification. Maintenance may include quality of service (QoS) testing, service level verification, probing endpoints, querying for services supported by a device, etc.

In Figure 5, an example of an implementation of delayed call establishment in conjunction with call completion on busy signal (CCBS) service is shown. User A starts the process by calling user B with CCBS activated. When the call fails, an intermediary device such as an H.323 Gatekeeper or SIP proxy transmits a Setup or INVITE request with a delay point identified as explicit notification. The called endpoint will transmit release messages indicating that the phone is busy. Periodically, the intermediary will re-attempt the call to User B. Once the phone is no longer busy, the called endpoint B sends a call proceeding or other appropriate message.

The intermediary then transmits a Setup message to the calling endpoint where user A resides. The delayed call establishment message includes the delay point of explicit notification. The endpoint A then informs the intermediary that the call is proceeding.

At this point in the process, the two legs will be joined. The calling endpoint sends a DPR message and the intermediary responds with DCE Release, allowing the calling endpoint to notify user A that the call is going through. The intermediary then transmits the DCE Release message to the called endpoint, and the called endpoint alerts the user. The two users are now on the line and the intermediary bridges the two call legs and the call proceeds as normal.

Most of the examples given above are based upon H.323 signaling. In Session Initiation Protocol (SIP) there are messages and parameters that are analogous to those discussed above. For example, in SIP the initial call setup message is INVITE, rather than

Setup. The response to the invitation message would be where the DCE capability would be advertised in response to an INVITE message that has DCE requested. Similarly, the call negotiation messages could easily be translated into SIP, with the intermediary being a SIP proxy server, rather than an H.323 Gatekeeper.

Thus, although there has been described to this point a particular embodiment for a method and apparatus for delayed call establishment, it is not intended that such specific references be considered as limitations upon the scope of this invention except in-so-far as set forth in the following claims.